**U.S. Fish and Wildlife Service**
**Maine Field Office**
**Special Project Report: FY02-MEFO-1-EC**

# ORGANOCHLORINE COMPOUNDS AND MERCURY IN BALD EAGLE EGGS, PENOBSCOT RIVER, MAINE

January 2002

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## ABSTRACT

Four bald eagle (*Haliaeetus leucocephalus*) eggs from three nests on the Penobscot River, Maine, were analyzed for organochlorine contaminants and mercury. Eggs were collected in June 2000 within two weeks of nest abandonment. Tetrachlorodibenzo-*p*-dioxin toxic equivalents (TEQs) based on World Health Organization toxic equivalency factors for birds were determined for each egg. TEQs determined solely from polychlorinated dibenzodioxins and dibenzofurans ($TEQ_{PCDD/Fs}$) in the four eggs ranged from 15 to 59 pg/g, fresh wet weight (mean 35 pg/g, fww), while Total $TEQs_{(PCDD/Fs + planar\ PCBs)}$ ranged from 223 to 570 pg/g, fww (mean 385 pg/g, fww). The percent of total TEQs derived from PCDD/Fs averaged approximately 8%. PCB# 126 was the greatest contributor to the Total TEQ. The mean concentrations of total PCBs and p,p'-DDE in eggs were 9.05 ：g/g, fww, and 1.53 ：g/g, fww, respectively. Compared to previous Maine eagle egg studies, DDE levels were not markedly elevated in these 4 eggs. TEQ and total PCB levels in Maine eggs, however, continue to exceed No Effect Levels suggested for bald eagles. Mercury concentrations in eggs ranged from 0.12 ：g/g to 0.25 ：g/g, fww (mean 0.17 ：g/g, fww). Mercury in these 4 eggs occurred at lower concentrations than previous Maine eagle egg studies and below suggested effects thresholds.

## PREFACE

This report summarizes organochlorine and mercury analytical results of four bald eagle eggs collected from three nest sites along the Penobscot River, Maine. Analytical funding for this study was provided by the Endangered Species Program of the U.S. Fish and Wildlife Service (USFWS).

Questions, comments, and suggestions related to this report are encouraged. Written inquiries should refer to Report Number FY02-MEFO-1-EC and be directed to:

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Copies of this report may be downloaded from the Maine Field Office Environmental Contaminants website http://mainecontaminants.fws.gov/reports (portable document file reader required).

## ACKNOWLEDGMENTS

The locations of addled eagle eggs were determined during overflights conducted by C. Todd, and personnel or contractors of the Maine Department of Inland Fisheries and Wildlife, USFWS, and the Maine Forest Service. Eagle eggs were recovered from nests by treeclimber B. Thompson. Analytical funding was secured through the efforts of K.Tripp and M. Amaral of the USFWS. Assistance with data interpretations and the adjustments for moisture loss was provided by J. Elliott of the Canadian Wildlife Service, C. Henny of the U.S. Geological Survey's Biological Resources Division, and T. Augspurger of the USFWS.

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## 1. Introduction

The bald eagle (*Haliaeetus leucocephalus*) is a highly charismatic wildlife species in Maine and the United States. In Maine, the species has been monitored by state and federal fish and wildlife agencies since the 1960s. Monitoring became more extensive and rigorous after the species was placed on the nation's Endangered Species List in 1978. In the decades following Endangered Species Act (ESA) listing, the breeding range and number of nesting pairs slowly increased throughout the state. Productivity of nesting pairs in Maine, however, has often been below ESA recovery goals (Owen *et al.* 1991). Poor breeding success in Maine bald eagles has been partly attributed to organochlorine compounds or mercury (Todd 1979, Wiemeyer *et al.* 1984, Wiemeyer *et al.* 1993, Welch 1994, Matz *et al.* 2000). The Penobscot River watershed has been an area of particular concern in eagle recovery efforts due to the discharge of organochlorine-contaminated effluent from kraft pulp and paper mills, and discharges from other mills, industries, municipalities, and non-point sources.

## 2. Study Purpose

The purpose of the study was:

- To determine levels of organochlorine compounds and mercury in bald eagle eggs collected from nest sites in the Penobscot River watershed.

## 3. Study Area

The study area is the Penobscot River watershed in Maine (Figure 1). The watershed encompasses 8,570 square miles and is comprised of five basins: the main stem and tributaries (including the Passadumkeag River system), the Piscataquis River basin, the Mattawamkeag River basin, the West Branch Penobscot, and the East Branch Penobscot (Baum 1983). Bald eagles have been regularly reported in northern portions of the Penobscot River watershed since monitoring plans were enacted. Eagles nesting along the Penobscot River represented one of the state's core riverine populations that greatly contributed to the recovery of the species in Maine (Todd C.S. 2001. Personal communication). Currently, the watershed has 78 bald eagle nesting areas (Todd 2000).

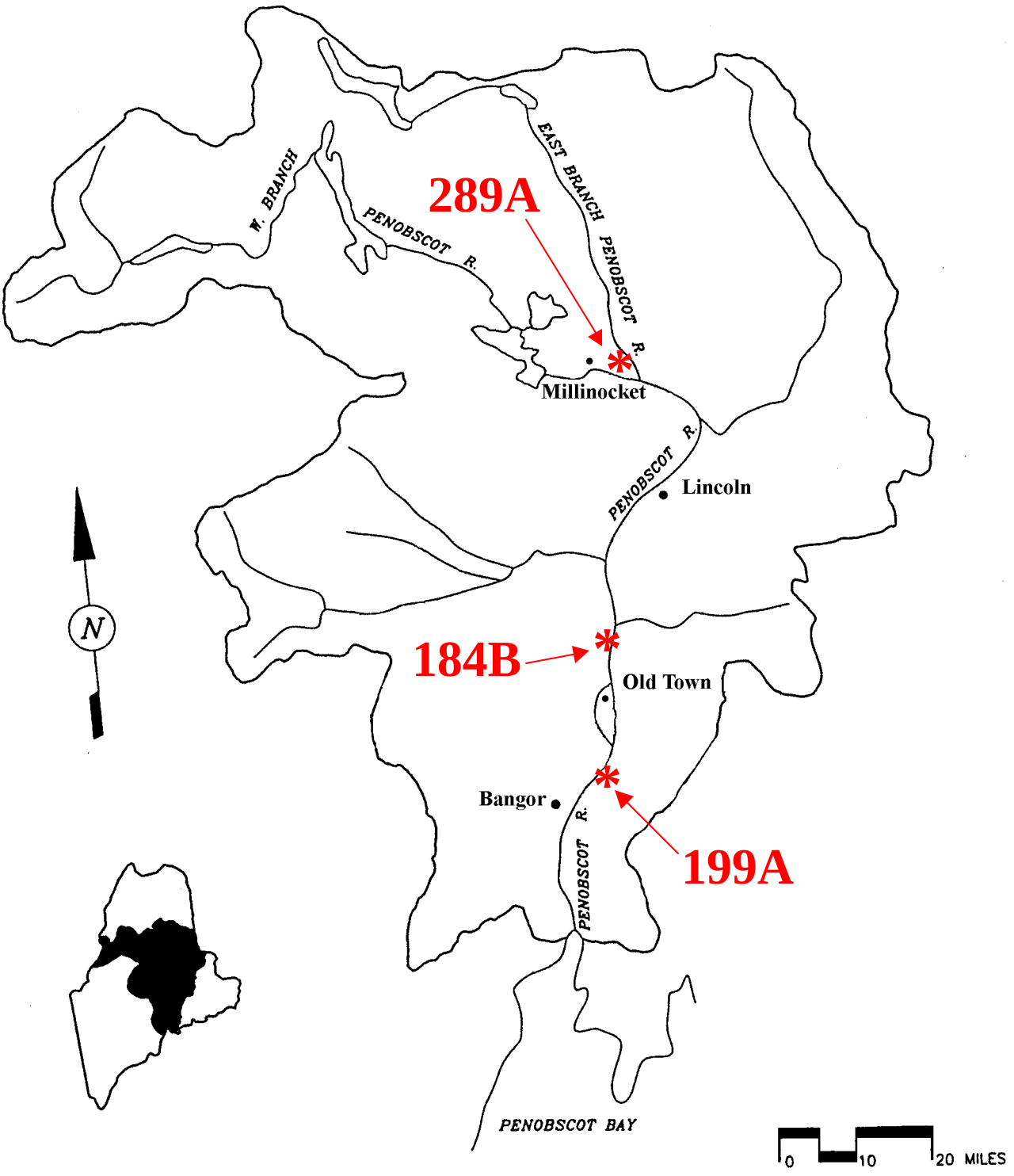
Addled eagle eggs were collected from three nest sites in the watershed (Figure 1). Nest ME289A, the most northern nest of the three sites, is located on the southwest shore of Dolby Pond. The pond is approximately 5 kilometers (3.1 miles) southeast and downriver from the center of the town of Millinocket. Dolby Pond is a shallow, 810 hectare (2,000 acre) Penobscot River impoundment that is bisected by State Highway Routes 157 and 11.

Nest ME184B, in the town of Argyle, is located on the left bank of the main stem of the river. The nearest significant population centers upriver of the Argyle nest are the towns of Howland and West

Enfield (16 kilometers or 10 miles) and the town of Lincoln (38 kilometers or 24 miles). The town of Old Town is located approximately 13 kilometers (8 mi.) south of the Argyle nest.

The southernmost nest is the study is ME199A in the town of Brewer. ME199A is also a main stem river nest site. Within 10 kilometers (6.2 mi.) of the nest are the towns of Veazie and Orono and the cities of Brewer and Bangor. On the bank of the river opposite nest ME199A is a large natural-gas electrical generating plant.

**Figure 1**. Penobscot River watershed and locations of egg collection sites



## 4. Methods

Nesting inventories and production surveys from fixed-wing aircraft are conducted annually by personnel of the Maine Department of Inland Fisheries and Wildlife and other agencies. During the flights conducted in June 2000, unattended eggs were observed during surveys along the Penobscot River. On 28 June 2000, approximately two weeks after the expected hatch date, four addled eggs were recovered from three eagle nests by a treeclimber (Table 1).

Eggs were measured (length, breadth, weight) in millimeters with dial calipers and scored at the equator with a stainless steel scalpels (Table 2). Egg contents were placed in contaminant-free glass jars with teflon-lined caps and frozen. Upon catalog approval, frozen samples were shipped overnight to the Geochemical and Environmental Research Group (GERG) at Texas A&M University. Egg contents were analyzed by GERG using EPA-approved analytical methods. All eggs were analyzed for metals, organochlorine pesticides, polychlorinated biphenyl congeners, polychlorinated dibenzodioxins (PCDD), and polychlorinated dibenzofurans (PCDF). QA/QC procedures were reviewed and approved by the USFWS Patuxent Analytical Control Facility (Appendix B pages 24-66, Appendix C pages 4-12). Contaminant concentrations are presented in the text and tables of this report on a fresh, wet-weight basis (adjusted for moisture loss) in pg/g (parts-per-trillion; TCDD, TEQs) and ：g/g (parts-per-million; OC pesticides, Hg). Contaminant data in the analytical laboratory reports (Appendices B & C) are presented in ：g/g dry and wet weight.

Eggs were collected within two weeks of abandonment and contained a high moisture content (> 80%). One egg, however, had a moisture content of only 63% (Table 2). Residue results were corrected for moisture loss (Stickel *et al*. 1973) and, as noted above, reported as fresh wet weight in pg/g (PCDD/Fs and planar PCBs) or ：g/g (Total PCBs, DDE, Hg). A volume adjustment factor was used on one egg, ME289A, to account for loss of material during processing.

**Table 1.** Coordinates of Penobscot River nests where eggs were collected.

| Nest No. | Collection Date | Township | Nest Location | Latitude | Longitude |
|---|---|---|---|---|---|
| ME289A | 28 JUN 00 | Millinocket | Dolby Pond | N45° 38' 58" | W68° 38' 16" |
| ME184B (2 eggs) | 28 JUN 00 | Argyle | River - Main Stem | N45° 06' 32" | W68° 38' 43" |
| ME199A | 28 JUN 00 | Brewer | River - Main Stem | N44° 49' 11" | W68° 42' 29" |

## 5. Results

**5.1 Egg Metrics** - Although the length (mean 75.2 mm, standard deviation 1.75) and breadth (mean 55.6 mm., standard deviation 1.49) of the four eggs were similar (Table 2), one egg, ME199A was considerably different in other aspects. Total weight of eggs varied from 44 grams to 123 grams; ME199A weighed the least.

Sample weight (i.e., egg contents) varied from 28 grams to 106 grams. Egg ME199A had considerably less mass than the other eggs. During processing, egg ME289A exploded and approximately one-third of the contents were unrecoverable for analysis. Since ME289A was similar in size (e.g., length, breadth, total weight) to the eggs from the Argyle nest, an adjustment factor based on the measurements of eggs ME184B-1 and ME184B-2 was used to estimate total volume in the exploded egg.

Percent moisture was similar in three eggs (range: 82.0 % to 83.1%), but considerably less in ME199A (63.1%). Lipid content ranged from 3.8 to 4.9% in three eggs, while ME199A had a lipid content of 13.2%. During processing, egg contents in ME199A appeared conspicuously different from the others. The contents of ME199A comprised a dense, coarse, gray mass. The contents of the other eggs were primarily liquid with small bits of yellow tissue.

**5.2 TCDD Toxic Equivalents (TEQs)** - PCDD/F and PCB congener concentrations in Maine bald eagle eggs have not been previously reported. Tetrachlorodibenzo-*p*-dioxin (TCDD) concentrations in the four eggs collected in 2000 ranged from non-detect to 8.9 pg/g, fww (Table 3). TEF-adjusted concentrations of PCDDs plus PCDFs resulted in TEQs $_{PCDD/F}$ ranging from 15 to 59 pg/g, fww. Adding TEF-adjusted PCB congeners to PCDD/Fs equivalents produced TEQs $_{Total}$ ranging from 223 pg/g to 570 pg/g, fww.

Four dioxin congeners were detected in bald eagle eggs (Appendix A, Table A-1). The most potent dioxin congener, 2,3,7,8-TCDD, was detected in two eggs (7.5 pg/g in ME184B-1, 8.9 pg/g in ME199A). OCDD was detected in all eggs and ranged from 0.007 pg/g to 0.03 pg/g. Three eggs had detectable 1,2,3,6,7,8-HexaCDD concentrations and 1,2,3,7,8,9-HexaCDD was detected in one egg. Dioxin congeners accounted for less than 1% of the TEQ $_{PCDD/F}$ in two eggs - the eggs with no detectable TCDD. However, in ME184B-1 and ME199A, dioxins accounted for 29% and 24%, respectively, of the TEQ $_{PCDD/F}$ in eggs.

The majority of the TEQ $_{PCDD/F}$ in each egg was comprised of 1,2,3,7,8-PentaCDF. This Penta-CDF congener accounted for 63%, 46%, 80%, and 58% of the TEQ $_{PCDD/F}$ in eggs ME289A, ME184B-1, ME184B-2, and ME199A, respectively. The 2,3,7,8-TCDF congener, which equals 2,3,7,8 TCDD in toxicity to birds, was detected in three of the four eggs (range: 3.8 pg/g - 7.8 pg/g). All eggs contained 1,2,3,4,6,7,8-HeptaCDD, which comprised over 20% of the TEQ $_{PCDD/F}$ of ME289A.

Non-*ortho* PCB congeners, particularly PCB 77 and PCB 126, were the greatest contributors to the $TEQ_{Total}$ in eagle eggs collected from Penobscot River nests in breeding year 2000 (Figure 2) PCB126 was the organochlorine congener comprising the majority of the $TEQ_{Total}$ (Appendix A, Table A-1). In egg ME199A, PCB126 accounted for 63% of the $TEQ_{Total}$.

**5.3 Total PCBs** - Total PCBs levels in three eggs were similar - 6.23 ：g/g, 7.25 ：g/g, and 7.63 ：g/g (Table 4). Total PCBs in the egg from Brewer (11.41 ：g/g, ME199A), however, were nearly double the concentration of the other eggs. The mean Total PCB concentration for all eggs was 9.05 ：g/g.

**5.4 DDE** - The DDT metabolite, DDE, was detected in all eggs. The highest concentration of DDE was found in the Brewer nest (ME199A @ 3.29 ：g/g) followed by the egg from Millinocket (0.99 ：g/g in ME289A) and the two Argyle eggs (0.75 ：g/g in ME184B-1 and 0.64 ：g/g in ME184B-2).

**5.5 Mercury (Hg)** - Mercury appeared highest in the egg from Millinocket (0.25 ：g/g, ME289A) and lowest in the two eggs from the Argyle nest - 0.12 ：g/g and 0.13 ：g/g in ME184B-1 and ME184B-2, respectively (Table 4). ME199A had a mercury concentration of 0.17 ：g/g.

**Table 2.** Egg metrics, percent moisture, and percent lipid

| Sample No. | Total Weight (g) | Sample Weight (g) | Length (mm) | Mean Breadth (mm) | Percent Moisture | Percent Lipid |
|---|---|---|---|---|---|---|
| ME289A | 118 | 66* | 75.2 | 55.6 | 82.0 | 4.9 |
| ME184B1 | 113 | 95 | 72.5 | 56.1 | 83.1 | 4.9 |
| ME184B2 | 123 | 106 | 75.2 | 57.5 | 82.8 | 3.8 |
| ME199A | 44 | 28 | 71.9 | 53.9 | 63.1 | 13.2 |

***** Portion of egg contents lost during processing.

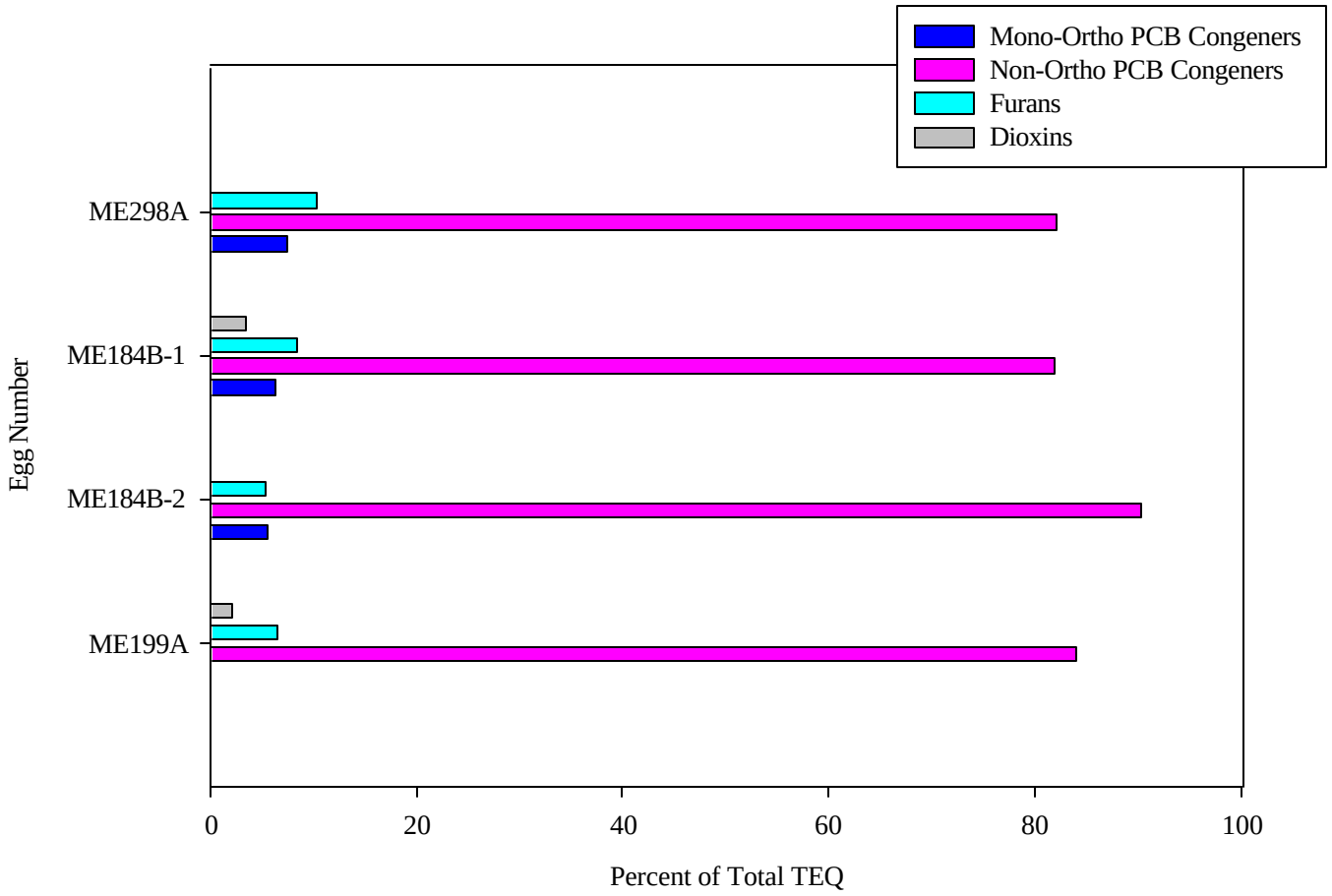
**Table 3.** TCDD, $TEQ_{PCDD/F}$, and $TEQ_{Total}$ in bald eagle eggs

| Nest Number and Location | Concentrations pg/g, fresh wet weight | | |
|---|---|---|---|
| | TCDD | $TEQ_{PCDD/F}$ | $TEQ_{Total}$ |
| ME289A (Millinocket) | non-detect | 59 | 570 |
| ME184B-1 (Argyle) | 7.5 | 26 | 223 |
| ME184B-2 (Argyle) | non-detect | 15 | 281 |
| ME199A (Brewer) | 8.9 | 40 | 467 |

**Table 4.** Total PCBs, DDE, and Hg in bald eagle eggs

| Nest Number and Location | Concentrations ：g/g, fresh wet weight | | |
|---|---|---|---|
| | Total PCBs | DDE | Hg |
| ME289A (Millinocket) | 7.63 | 0.99 | 0.25 |
| ME184B-1 (Argyle) | 7.25 | 0.75 | 0.12 |
| ME184B-2 (Argyle) | 6.23 | 0.64 | 0.13 |
| ME199A (Brewer) | 11.41 | 3.29 | 0.17 |

**Figure 2**. Percentages of Organochlorine Groups Comprising TEQ




(Dioxins account for less than 1% in ME289A and ME184B-2)

## 6. Discussion

**6.1 TCDD Toxic Equivalents (TEQs)** - Tetrachlorodibenzo-*p*-dioxin (TCDD) toxic equivalents (Van den Berg *et al*. 1998) in the four eggs collected from nests along the Penobscot River were elevated when compared to suggested No-Effect-Levels for bald eagles and other raptors. An eagle-based, No-Effect-Level TEQ continues to evolve. In early hazard assessment models related to organochlorines and eagles, No-Effect-Levels of 1 pg/g, 7 pg/g, and 20 pg/g have been suggested (Kubiak and Best 1991, USFWS 1994, USFWS 1995, Bowerman *et al*. 1995, Giesy *et al*. 1995, USFWS 1996). These models were based on the effects of TCDD on chickens or other birds (e.g., pheasants and ducks) and extrapolated to bald eagles. More recent research to determine the potential effects of PCDD/Fs on raptors has been conducted in British Columbia with bald eagles and in Wisconsin with osprey. Elliott *et al*. (1996) examined bald eagle eggs collected in reference areas and near British Columbia pulp mills and suggested an egg NEL of 100 pg/g based on enzyme induction. In a re-analysis of their egg data, a NEL of 303 pg/g based on eagle egg hatchability has also been suggested (Elliott *et al*. in press). In a study of Wisconsin osprey, Woodford *et al*. (1998) concluded that the no-observable-adverse-effect level for embryo survival was equal to or greater than 136 pg/g. TEQs in bald eagle eggs from Penobscot River nests (mean 385 pg/g, range: 223 - 570 pg/g) were above the most recently suggested raptor NELs for enzyme induction, embryo survival, or egg hatchability.

**6.2 Total PCBs** - Total polychlorinated biphenyls (PCBs) have been measured in eagle eggs in several Maine studies (Wiemeyer *et al*. 1984, Wiemeyer *et al*. 1993, Welch 1994). Total PCB levels in four eggs from the Penobscot River watershed in 2000 were 6.23 ：g/g, 7.25 ：g/g, 7.63 ：g/g and 11.41 ：g/g. Compared to previous Maine bald eagle egg studies, eggs collected from the Penobscot River in 2000 were not highly elevated (Table 5). Total PCB concentrations in eggs from the Penobscot basin, however, remain within the lower end of the suggested adverse effect range (8 to 25 ：g/g; Hoffman *et al*. 1996).

**6.3 DDE** - DDE concentrations in Penobscot River bald eagle eggs from 2000 appeared lower than eggs collected state-wide during the three previous decades (Table 5). The mean DDE concentration of 1.5 ：g/g (range: 0.64 - 3.29 ：g/g) in Penobscot River eagle eggs is below the suggested reproductive effect level of 3.6 ：g/g (Wiemeyer *et al*. 1993).

**6.4 Mercury (Hg)** - Mercury in bald eagle eggs from the Penobscot River basin appeared to be lower than concentrations reported in earlier state-wide studies (Table 6). In 2000, the mercury levels in four eggs from the Penobscot watershed (0.12 ：g/g, 0.13 ：g/g, 0.17 ：g/g, 0.25 ：g/g) were less than the suggested adverse reproductive effect level of 0.50 ：g/g (Wiemeyer *et al*. 1984).

**Table 5.** Total PCBs and DDE bald eagle eggs from Penobscot River nests compared to state-wide Maine studies

| Year(s) | n | Concentrations : g/g fww | | | |
|---|---|---|---|---|---|
| | | Total PCBs | | p,p'-DDE | |
| | | Mean | Range | Mean | Range |
| 1974-1979[a] | 19 | 23.6 | 5.4 - 75.0 | 16.7 | 4.8 - 42.0 |
| 1980-1984[b] | 12 | 17.1 | 6.7 - 37.0 | 8.2 | 5.0 - 16.0 |
| 1991[c] | 7 | 16.5 | 2.7 - 66.1 | 4.4 | 1.0 - 10.9 |
| 2000[d] | 4 | 9.05 | 6.2 - 11.4 | 1.5 | 0.6 - 3.3 |

[a] Wiemeyer *et al*. 1984, [b] Wiemeyer *et al*. 1993, [c] Welch 1994, [d] This study

**Table 6.** Mercury concentrations in bald eagle eggs from Penobscot River nests compared to state-wide Maine studies

| Year(s) | n | Hg Concentration, : g/g fww | |
|---|---|---|---|
| | | Mean | Range |
| 1974-1979[a] | 19 | 0.4 | 0.03 - 1.2 |
| 1980-1984[b] | 12 | 0.4 | 0.19 - 1.3 |
| 1991[c] | 7 | 0.4 | 0.22 - 1.3 |
| 2000[d] | 4 | 0.17 | 0.12 - 0.25 |

[a] Wiemeyer *et al*. 1984, [b] Wiemeyer *et al*. 1993, [c] Welch 1994, [d] This study

## 7. Conclusions

TCDD toxicity equivalents (TEQs) based on concentrations of PCDDs, PCDFs, and planar PCBs were elevated in four bald eagle eggs collected from three nests in the Penobscot River watershed, Maine. TEQs exceeded suggested biological effect levels for bald eagles. Non-*ortho* PCB congeners, particularly PCB #126, were the greatest contributors to the TEQ.

PCBs and p,p'-DDE continue to persist in Maine bald eagle eggs. Total PCB levels in eggs remain within the lower end of the adverse effects range. DDE concentrations in eggs were less than concentrations reported in previous Maine studies, and below the threshold level for reproductive effects.

Mercury in bald eagle eggs from the Penobscot River basin appeared to occur at lower concentrations than levels reported in earlier Maine studies. None of the four eggs had mercury concentrations that exceeded the suggested reproductive effects level.

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# APPENDIX A

Table A-1. TCDD-TEQ Calculations
Table A-2. Egg Volume Calculations
Table A-3. Derivation of Adjustment Factors

**Table A-1**. TEQs for Breeding Year 2000 Bald Eagle Eggs from the Penobscot River, pg/g fresh wet weight*.

| Congeners | TEF | ME289A Dolby Pond | | ME184B1 Argyle | | ME184B2 Argyle | | ME199A Brewer | |
|---|---|---|---|---|---|---|---|---|---|
| **Dioxins** | | Adj Conc* | TEQ | Adj Conc* | TEQ | Adj Conc* | TEQ | Adj Conc* | TEQ |
| 2,3,7,8-TCDD | 1 | | | 7.5072 | 7.5072 | | | 8.942 | 8.942 |
| 1,2,3,6,7,8-HxCDD | 0.01 | 8.1774 | 0.081774 | | | 8.6005 | 0.086005 | 24.8009 | 0.248009 |
| 1,2,3,7,8,9-HxCDD | 0.1 | | | | | | | 3.2875 | 0.32875 |
| OCDD | 0.0001 | 309.75 | 0.030975 | 71.4816 | 0.00714816 | 74.8995 | 0.00748995 | 355.05 | 0.035505 |
| **Furans** | | | | | | | | | |
| 2,3,7,8-TCDF | 1 | 7.847 | 7.847 | 3.8352 | 3.8352 | | | 3.9713 | 3.9713 |
| 1,2,3,7,8-PeCDF | 0.1 | 378.308 | 37.8308 | 119.952 | 11.9952 | 124.415 | 12.4415 | 229.599 | 22.9599 |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 1338.12 | 13.3812 | 300.288 | 3.00288 | 241.315 | 2.41315 | 336.64 | 3.3664 |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | | | | | | | 20.5403 | 0.205403 |
| OCDF | 0.0001 | 37.583 | 0.0037583 | | | 23.046 | 0.0023046 | 9.7836 | 0.00097836 |
| TEQ PCDD/F | | | 59 | | 26 | | 15 | | 40 |
| **Non-ortho PCBs** | | | | | | | | | |
| PCB# 77 | 0.05 | 3873.94 | 193.697 | 1460.64 | 73.032 | 1920.5 | 96.025 | 1625.34 | 81.267 |
| PCB# 126 | 0.1 | 2444.96 | 244.496 | 1093.44 | 109.344 | 1185.7 | 118.57 | 2945.6 | 294.56 |
| PCB# 169 | 0.001 | | | | | | | 526 | 0.526 |
| PCB# 81 | 0.1 | 299.012 | 29.9012 | | | 392.45 | 39.245 | 165.164 | 16.5164 |
| **Mono-ortho PCBs** | | | | | | | | | |
| PCB# 105 | 0.0001 | 99946 | 9.9946 | 36801.6 | 3.68016 | 28557 | 2.8557 | 77322 | 7.7322 |
| PCB# 156 | 0.0001 | 260190 | 26.019 | 74664 | 7.4664 | 66132 | 6.6132 | 205140 | 20.514 |
| PCB# 118 | 0.00001 | 514598 | 5.14598 | 254592 | 2.54592 | 221275 | 2.21275 | 531260 | 5.3126 |
| PCB# 167 | 0.00001 | 92512 | 0.92512 | 34843.2 | 0.348432 | 30060 | 0.3006 | 71273 | 0.71273 |
| PCB# 189 | 0.00001 | 19328.4 | 0.193284 | 881.28 | 0.0088128 | 7439.85 | 0.0743985 | 16306 | 0.16306 |
| TEQ Total (PCDD/Fs + planar PCBs) | | | 570 | | 223 | | 281 | | 467 |
| Percent of TEQ Total from PCDD/Fs | | | 10% | | 12% | | 5% | | 8% |

* Adjusted for moisture loss.
TEFs from Van den Berg *et al* . 1998

**Table A-2**. Egg Volume Calculations

Equation: Egg Volume = 0.51 * Egg Length * (Egg Breadth)$^2$

| Egg No. | Volume Coefficient (Kv) | Egg Length (cm) | Egg Breadth$^2$ (cm) | Egg Volume |
|---|---|---|---|---|
| ME289A | 0.51 | 7.52 | 30.9 | 118.6 |
| ME184B1 | 0.51 | 7.25 | 31.5 | 116.4 |
| ME184B2 | 0.51 | 7.52 | 33.1 | 126.8 |
| ME199A | 0.51 | 7.19 | 29.1 | 106.5 |

Volume equation derived from Stickel *et al.* (1973).

**Table A-3**. Derivation of Adjustments Factors to Calculate Fresh Wet Weight Concentrations

Equations:
Adjustment Factor = Whole Sample Wet Weight/Egg Volume
ppm (Fresh Wet Weight) = (Adjustment Factor) * (ppm, Reported Wet Weight Value)

| Sample No. | Whole Sample Wet Weight (g) | Egg Volume | Adjustment Factor |
|---|---|---|---|
| ME289A | 66 | 118.6 | 0.825[a] |
| ME184B1 | 95 | 116.4 | 0.816 |
| ME184B2 | 106 | 126.8 | 0.836 |
| ME199A | 28 | 106.5 | 0.263 |

[a] Due to loss of sample material during processing, the equation was not used for Sample ME289A.
The adjustment factor for ME289A is the mean ME184B1 and ME184B2, which had dimensions similar to ME289A.

# APPENDIX B - Eggs

# Organochlorines

ECDMS Analytical Report
Geochemical & Environmental Research Group
Texas A&M, College Station, Texas
2/01/01

Available upon request from:

Maine Field Office
U.S. Fish and Wildlife Service
1033 South Main Street
Old Town, ME 04468

# APPENDIX C - Eggs

## Trace Elements

ECDMS Analytical Report
Geochemical & Environmental Research Group
Texas A&M, College Station, Texas
1/26/01

Available upon request from:

Maine Field Office
U.S. Fish and Wildlife Service
1033 South Main Street
Old Town, ME 04468